CLAIMS

What is claimed is:

1. Space transformer for a probe card assembly, comprising:

a space transformer substrate having a top surface, a bottom surface, a first plurality of terminals disposed on the top surface, and a second plurality of terminals disposed on the bottom surface; and

a first plurality of resilient contact structures mounted directly to the first plurality of terminals.

2. Space transformer, according to claim 1, further comprising:

tip structures mounted to ends of the first plurality of resilient contact structures.

3. Space transformer, according to claim 1, wherein:

the first plurality of resilient contact structures are composite interconnection elements.

4. Space transformer, according to claim 1, wherein:

the first plurality of resilient contact structures are fabricated on a sacrificial substrate prior to mounting the first plurality of resilient contact structures directly to the first plurality of terminals.

5. Space transformer, according to claim 1, further comprising:

a second plurality of resilient contact structures mounted directly to the second plurality of terminals.

6. Space transformer, according to claim 1, wherein:

the second plurality of resilient contact structures

are composite interconnection elements.

7. Space transformer, according to claim 1, wherein:

the second plurality of resilient contact structures are fabricated on a sacrificial substrate prior to mounting the second plurality of resilient contact structures directly to the second plurality of terminals.

8. Probe Card Assembly, comprising:

a probe card having a top surface, a bottom surface and a plurality of contact terminals on the top surface thereof;

an interposer having a top surface, a bottom surface, a first plurality of resilient contact structures extending from the bottom surface thereof and a second plurality of contact structures extending from the top surface thereof; and

a space transformer having a top surface, a bottom surface, a plurality of contact pads disposed on the bottom surface thereof, and a third plurality of resilient contact structures extending from the top surface thereof;

wherein:

the first plurality of resilient contact structures effect a pressure connection with the contact terminals of the probe card; and

the second plurality of resilient contact structures effect a pressure connection with the contact pads of the space transformer.

9. Probe Card Assembly, according to claim 8, wherein:

the third plurality of resilient contact structures are mounted directly to terminals on the top surface of the space transformer.

10. Probe Card Assembly, according to claim 8, wherein:

the first plurality of resilient contact structures are composite interconnection elements.

11. Probe Card Assembly, according to claim 8, wherein:

the second plurality of resilient contact structures are composite interconnection elements.

12. Probe Card Assembly, according to claim 8, wherein:

the third plurality of resilient contact structures are composite interconnection elements.

13. Probe Card Assembly, according to claim 8, wherein:

each one of the first plurality of resilient contact structures are at least two composite interconnection elements.

14. Probe Card Assembly, according to claim 8, wherein:

each one of the second plurality of resilient contact structures are at least two composite interconnection elements.

15. Probe Card Assembly, according to claim 8, further comprising:

a front mounting plate made of a rigid material, having a top surface and a bottom surface, and disposed with its bottom surface against the top surface of the probe card;

means for affixing the front mounting plate to the top surface of the probe card; and

means for urging the space transformer against the top surface of the probe card.

16. Probe Card Assembly, according to claim 15, wherein:

the front mounting plate is made of stainless steel.

17. Probe Card Assembly, according to claim 15, wherein the means for urging the space transformer comprises:

a mounting ring; and

a plurality screws holding the mounting ring to the front mounting plate with the space transformer captured

therebetween.

18. Probe Card Assembly, according to claim 17, wherein:
the mounting ring is made of a springy material.

19. Probe Card Assembly, according to claim 17, further comprising:

a spacer ring disposed between the mounting ring and the top surface of the space transformer.

20. Probe Card Assembly, according to claim 15, wherein the means for affixing the front mounting plate comprises:

a rear mounting plate made of a rigid material, having a top surface and a bottom surface, and disposed with its top surface against the bottom surface of the probe card; and

a plurality of screws extending between the front mounting plate and the rear mounting plate, through the probe card.

21. Probe Card Assembly, according to claim 20, wherein:
the rear mounting plate is made of stainless steel.

22. Probe Card Assembly, according to 8, further comprising:

means for adjusting the planarity of the space transformer without changing the orientation of the probe card.

23. Probe Card Assembly, according to claim 22, wherein the means for adjusting the planarity of the space transformer comprises:

a plurality of differential screws, each including an outer differential screw element an inner differential screw element, acting upon the bottom surface of the space transformer.

24. Probe Card Assembly, according to claim 23, further comprising:

a plurality of pivot spheres disposed on ends of the inner differential screw elements.

25. Probe Card Assembly, according to claim 23, further comprising:

an actuator mounting plate disposed beneath the probe card;

wherein:

the differential screws are threaded into the actuator mounting plate.

26. Probe Card Assembly, according to claim 22, wherein the means for adjusting the planarity of the space transformer comprises:

a plurality of actuators, responsive to a computer, acting upon the bottom surface of the space transformer.

27. Probe Card Assembly, according to claim 8, wherein:

the contact pads are disposed at a first pitch on the bottom surface of the space transformer;

the third plurality of resilient contact structures are disposed at a second pitch on the top surface of the space transformer; and

the first pitch is greater than the second pitch.

28. Probe Card Assembly, according to claim 8, wherein:

the first plurality of resilient contact structures are disposed at a first pitch on the bottom surface of the interposer;

the second plurality of resilient contact structures are disposed at a second pitch on the top surface of the interposer; and

the first pitch is the same as the second pitch.

29. Probe Card Assembly, according to claim 8, wherein:

the contact pads are disposed at a first pitch on the bottom surface of the space transformer;

the third plurality of resilient contact structures are disposed at a second pitch on the top surface of the space transformer;

the first plurality of resilient contact structures are disposed at the first pitch on the bottom surface of the interposer;

the second plurality of resilient contact structures are disposed at the first pitch on the top surface of the interposer; and

the first pitch is greater than the second pitch.

30. Probe Card kit, comprising:

a space transformer having a top surface, a bottom surface, a plurality of contact pads disposed on the bottom surface thereof, and a first plurality of resilient contact structures extending from the top surface thereof, said space transformer adapted in use for tips of the first plurality of resilient contact structures making pressure contacts with a plurality of contact areas on a semiconductor wafer; and

an interposer having a top surface, a bottom surface, a second plurality of resilient contact structures extending from the top surface thereof, said interposer adapted in use for tips of the second plurality of resilient contact structures making pressure connections with the plurality of contact pads on the bottom surface of the space transformer, the interposer having a third plurality of contact structures extending from the bottom surface thereof, said interposer adapted in use for tips of the third plurality of resilient contact structures making pressure connections with a plurality of terminals on a probe card.

31. Probe Card Kit, according to claim 30, wherein:

the contact pads are disposed at a first pitch on the bottom surface of the space transformer;

the first plurality of resilient contact structures are disposed at a second pitch on the top surface of the space transformer; and

the first pitch is greater than the second pitch.

32. Probe Card Kit, according to claim 30, wherein:

the third plurality of resilient contact structures are disposed at a first pitch on the bottom surface of the interposer;

the second plurality of resilient contact structures are disposed at a second pitch on the top surface of the interposer; and

the first pitch is the same as the second pitch.

33. Probe Card Assembly, according to claim 30, wherein:

the contact pads are disposed at a first pitch on the bottom surface of the space transformer;

the first plurality of resilient contact structures are disposed at a second pitch on the top surface of the space transformer;

the third plurality of resilient contact structures are disposed at the first pitch on the bottom surface of the interposer;

the second plurality of resilient contact structures are disposed at the first pitch on the top surface of the interposer; and

the first pitch is greater than the second pitch.

34. Method of planarizing tips of probes on an interposer assembly, comprising:

providing a support substrate having a top surface, a bottom surface, and a plurality of probe elements extending

from the top surface, each probe element having a tip at an end distal from the top surface of the support substrate;

mounting the support substrate on a probe card having a top surface, the bottom surface of the support substrate opposing the top surface of the probe card, said support substrate having an orientation, said probe card having an orientation; and

adjusting the orientation of the support substrate without altering the orientation of the probe card, so as to planarize the tips of the probe elements.

35. Resilient contact structure comprising:

a composite interconnection element having an end; and

a pre-fabricated tip structure joined to the end of the composite interconnection element.

36. Resilient contact structure, according to claim 35, wherein:

the resilient contact structure is a probe element mounted to a space transformer.

37. Method of fabricating tip structures for ends of contact structures, comprising:

depositing at least one layer of at least one conductive material on a surface of a silicon wafer;

depositing a layer of masking material atop the at least one conductive layer;

patterning openings in the masking material;

depositing at least one layer of at least one conductive material into the openings; and

removing the masking material.

38. Method, according to claim 37, further comprising:

depositing a joining material on the at least one

layer of at least one conductive material previously deposited in the openings.

39. Method, according to claim 38, further comprising:

joining the tip structures to ends of contact structures.

40. Method, according to claim 39, wherein:

the contact structures are resilient contact structures.

41. Method, according to claim 39, wherein:

the contact structures are composite interconnection elements.

42. Method, according to claim 39, wherein:

the contact structures are resilient contact structures disposed atop a space transformer of a probe card assembly.